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ABSTRACT

Presented is a curriculum in archaeology for grades 6, 7, and 8. The curriculum covers 10,000 years of history common to America and presents material for interdisciplinary presentation. The effectiveness of the curriculum, based on evaluation data, is predicted. Data were collected via a pre- and post-test. Validity, sensitivity, and reliability measures are presented for the evaluative instrument. Conclusions drawn from the study are included. (RE)

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PROGRAM AREA: Archeology, grades 6-8 and gifted, grades 4-6; Social Studies/Science

I. PROJECT TITLE, LOCATION:

Project Archeology: Saving Traditions (P.A.S.T.)

Pacific Science Center
200 Second Avenue North
Seattle, WA 98109

II. DEVELOPED BY: Nan Munsell, Pacific Science Center/ Educational Service District 121

III. SOURCE AND LEVEL OF FUNDING: E.S.E.A. Title IV-C - $107,619.00

IV. YEARS OF PROJECT DEVELOPMENT: 1976, 1977, 1978.

V. BRIEF DESCRIPTION OF THE PROGRAM:

Project Archeology: Saving Traditions (P.A.S.T.) is an archeology curriculum with goals: 1) to increase 6th, 7th, and 8th graders' knowledge of archeology; 2) to strengthen these students' basic skills in social studies, science, mathematics and language arts; 3) to create a curriculum for teachers that would relate the content and skills of social studies, science, mathematics and language arts; and 4) to sensitize future adults to the need for conservation archeology in their own communities.

P.A.S.T. presents new knowledge which has not yet been available to any elementary or secondary students. This new curriculum covers the past 10,000 years of history combining both archeological evidence and past Northwest cultures. Because P.A.S.T. utilizes general archeological concepts and archeological activities common to all parts of the country, the curriculum can be easily adapted by schools outside the Northwest Coast region.

P.A.S.T. is activity oriented. It evokes conversation and social interaction among small and large groups, both outdoors and in the classroom. The activities allow the students to handle equipment and share experiences of the archeologist, and bring the students into contact with the archeology of their own community. The activities are also oriented towards problem solving, asking the student to analyze and react to situations, applying new skills in her/his own intuitive way.

P.A.S.T. is a middle school curriculum which stresses basic skills through classroom and outdoor activities. Rather than isolating these skills, P.A.S.T. emphasizes the interrelationship between social studies, science, math and language arts.

The core activities of the curriculum can be taught over a school quarter or the 70 hours of participatory activities can be expanded over an entire semester. The materials include: teachers activity guide, student books, filmstrips, *Artifakes*, games, maps and equipment.

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P.A.S.T. encourages our students to explore cultural and environmental adaptations of their community, viewing history from an exciting new perspective. This curriculum helps students to better understand the way we live today and lends substance to decisions they will have to make in the future regarding our archeological resources.

What claims of effectiveness are being made?

Students who participate in P.A.S.T. will show significantly greater growth (statistically significant, $p > .01$ level) in archeological knowledge than a randomly selected control group.

Students who participate in P.A.S.T. will decrease the descrepancy in mastery of archeological knowledge and concepts between middle school pre-test performance and mean performance of a college level archeology class by approximately 50 percentage points.

Who are the intended users and beneficiaries?

The community being served over the past 3 years has been a large metropolitan area with a cross-section of socio-economic, cultural background and ability levels. Eleven hundred students of grades 4,5,6,7, and 8, from public and non-public schools of the greater Seattle region received instruction through P.A.S.T. These students represent both urban and suburban communities as well as lower to upper middle class families. Included in this sample were students of the 6, 7 and 8th grades and gifted 4,5, and 6th graders. Gifted 4,5, and 6th graders were included in this sample upon request of the school districts participating. These districts' needs for gifted match the program goals of P.A.S.T.

How much will P.A.S.T. cost for an adoption?

The cost shown in section VII is set up for a district adoption involving four teachers in the program. This is not a required number of teachers; an adoption could be more or less. Based on this four-teacher adoption, approximately 360 students could be served with a cost of $16.00 per student for the initial year. This covers the expense of workshop/in-services, testing, curriculum materials and equipment. The second year of the program, expenses drop to $.50 per student. This expense is mainly for replacing the stones needed for tool technology. These costs do not include salaries for classroom teaching time, secretarial or classroom/office space.

Interpretability of the quantitative measures.

The design used in this study was a standard repeated measure design and was used to determine: a) if any treatment effects occured and b) if these results could be explained by chance alone. Students were randomly assigned (by classes) to experimental and control conditions. Subjects participating in the study (years 1976-77, 1977-78) were in 6th, 7th and 8th grade science and social studies classes and 4th, 5th and 6th grade

gifted students. The students, from 16 schools, represented both urban and suburban communities as well as lower to upper middle class families. The total experimental group for these two years (n=551) was given similar treatment, while the control group (n=300) received only the pre-/post testing with no instruction in archeology. Data were collected prior to an following the instruction period.

The primary instrument used to evaluate Project Acheology was developed by project staff during the first eight months of the project with revisions at the beginning of 1977-1978. This instrument, a combination of multiple choice, True/False, matching and write-in, was designed to measure the following skills: description, recording data, measurement (metric), graphing, mapping skills, compare work, hypothesis formation, sorting data, classifying information and conclusion formation. Included were content questions regarding the basic concepts of archeology, which provided the basis for item development.

> The relationship between people and their environment; biotic, physical, and social, can help explain differences and similarities in cultural traditions. -Hypothesis.
>
> In any undisturbed deposit of archeological material, the youngest deposit is at the top and the oldest is at the bottom. -Principle
>
> Archeology involves the survey, excavation, analysis and/or conservation of sites and materials in order to preserve the history of human's lifeways and to understand the interaction of humans and their environment in the past. This preservation and understanding help us live better our lives today and make appropriate planning and predictions on how to improve our lifeways in the future. -Definition

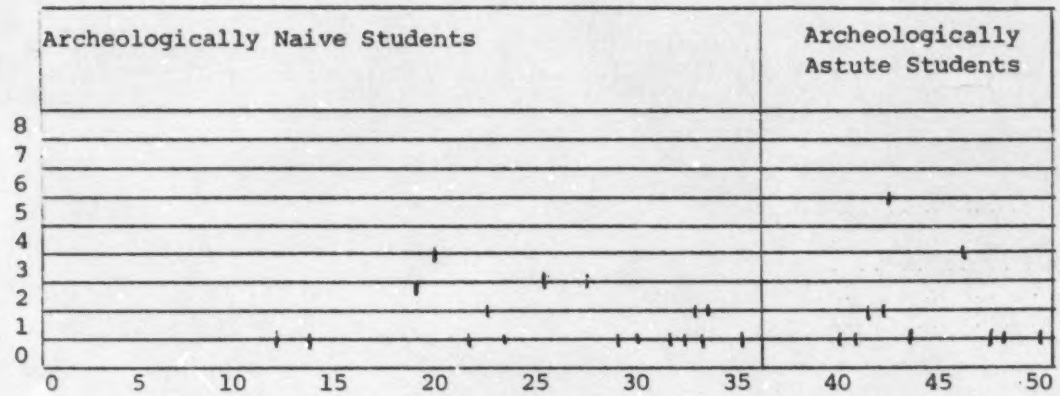
Because this instrument was to be used to evaluate the project effort, every attempt was made to tailor the instrument to be valid and sensitive with respect to the particular curriculum being evaluated. (Project staff were unable to locate any commercially developed instrument relevant to the curriculum under study.) The following steps and procedures were taken to assess the validity, sensitivity, and reliability of the instrument.

Content and Construct Validity

During the development of the instrument, each item was evaluated by 3 professional archeologists to determine if the item adequately measured the specific archeological concept being assessed. Any item failing this test was revised until it was considered to be adequate by all of the archeologists.

As a further test for validity, the instrument was administered to an archeologically naive population (n=28) and an archeologically astute popoulation (n=21). The naive population was made up of sixth grade students (the target population) who had had no exposure to the archeology curriculum, while the astute population was college students enrolled in a field study archeology course at the University of Idaho. Although the groups were dissimilar, the data provided a priori analysis of the sophistication and discriminative ability. As can be seen from the following table, there was no overlap between the naive and astute groups.

TABLE I - Number of Items Correct
Total Number - 50 points.



Sensitivity Assessment

During the construction and early use of the instrument in both years, 1976-1977 and 1977-1978, steps were taken to eliminate (or revise) any items that did not add to the sensitivity of the instrument. The testing instrument was pilot-tested on a group of students during the summer prior to the study. Any item correctly answered by less than ten percent of the population prior to instruction was eliminated or revised. Likewise, any itm answered correctly by more than 90 percent of the population after instruction was eliminated or revised. The test was then administered to archeologically naive and astute populations with no serious floor or ceiling effects obtained. (See Table I.)

Reliability (Consistency)

Both the test-retest and split-half reliability measures were obtained to determine the consistency of the instrument.

The test-retest measures were taken on twenty target populations students with a ten-day interval between testings. A Pearson product-moment correlation was computed with a r=.82 resulting, indicating stability of the measure across time.

To test the internal consistency of the instrument, a split-half correlation (r=.76) indicated that the elements of the test were internally consistent.

Credibility of Evidence

All tests were administered by the classroom teacher, under the supervision of the project manager, using standardized testing procedures to collect data. The data was analyzed by Dr. Ralph Carlson, project evaluator, Appropriate analysis of variance and "t" tests were done to determine statistical significance. All statistical calcuations were done on a Monroe-1860 and repeated for accuracy.

VI. EVIDENCE OF EFFECTIVENESS:

Analysis for Overall Treatment Effect

An initial analysis was performed to determine overall treatment effects. This analysis was performed using classroom means because classrooms, not students, constituted the "true" random sample and the large sample size (Experimental - N=250)[1] would have produced a statistically significant gain with little actual treatment effect. In essence, these procedures were selected as they represented the most robust design. A "t" test between the pretest means of the experimental and control groups indicated that both groups were selected from the same population. The means and standard deviations for both groups support the assumption of random selection.

Table II. "t" Test for Comparability of Pretest Scores

The means of each class represent the single scores entered for this analysis.

	N classes	$\bar{M}$	SD	df	t
Experimental	10	21.0	2.2	17	.04
Control	9	21.4	2.7		

A one-way analysis of variance (Kerlinger 1964) was performed using the post test means. As there were 10 experimental scores and only 9 control group scores, a tenth control group score was derived from the means of the other nine scores. The outcome of this analysis is shown below.

Table III. Analysis of Variance for Treatment Effects (separate scores

Source	df	SS	MS	F
between	1	362.1	362.1	
within	18	256.0	14.2	25.5*
Total:	19	618.1		

*P < .01

As the data from Table III show, there is a strong treatment effect. The descriptive data below shows that the effects were in the predicted direction.

[1]Note: N=250 is not total treatment group. Gifted comprised n=27 and five classrooms (experimental) test scores were invalid because of the control groups failing to take the post tests. Post testing came at the end of the school year - a difficult time for testing.

Table IV. Post Test Means and Standard Deviations for Experimental and Control Groups

	N Classes	$\bar{M}$	SD
Experimental	10	32.3	3.5
Control	10	23.6	3.1

Analysis for Differential Treatment Effects

A second level of analysis was performed to examine the effects of different amounts of treatment on performance. This was a post hoc analysis and looked at the effects of differences in the amount of the curriculum presented by the various teachers participating in the study. The project manager determined how much of the curriculum had in fact been presented in each of the experimental classrooms by the end of the study. Each class was then rated as receiving 100%, 75%, 50%, 25% or 0% of the curriculum. The 50th percentile had only one representative and was therefore dropped from the analysis. The students representing 0% treatment were selected from the control group. Those of the 100% represented 6th grade classrooms. A one-way analysis of variance was performed to determine if any differences occured between the four treatments. Students were chosen randomly from each condition from several different classrooms. As can be seen from Table V, there was a significant differential treatment effect.

Table V. Analysis of Variance for Differential Treatment Effects

Source	df	SS	MS	F
between	3	4621	1540.3	24.1*
within	128	8195	64.0	
TOTAL:	131	12816		

$P < .01$

Table VI. Means and Standard Deviations for the Four Different Degrees of Treatment

Amount of Treatment	N Students	$\bar{M}$	SD	t
100%	33	35.8	7.6	
75%	33	35.5	7.9	
50%	--	----	---	4.6*
25%	33	26.1	8.6	
0%	33	22.2	8.0	

*$P < .01$

As can be seen from the preceding table, any treatment above 75% produced a strong treatment effect while treatments below 25% produced no significant results. It is unfortunate that the sample size was not adequate for analysis at the 50% level as that may have been the critical necessary and sufficient level. The data does, however, suggest that partial (75%) presentation of the curriculum materials still yields good student performance. This outcome appears to enhance the probability of successful dissemination where the adopting district may not wish to use the total curriculum.

Analysis of Treatment Effect with 6th, 7th and 8th Graders.

To determine whether there were any differences in performance by grade level, the students were separated prior to testing and scores analyzed based on separate grades and classes during the first year of the study. The data from this analysis showed that the gains were significant for all experimental levels, and that grade level was not a factor.

Analysis of Treatment Effects with Gifted Students

A subpopulation of the treatment and control population was drawn from gifted students in self contained classrooms in one of the participating school districts.[2]

An analysis of these results were done separately to test the appropriateness of this curriculum for use with gifted students. As can ben seen from the table below, the gifted students obtained higher pre-test scores than the regular population thus supporting the idea that these students were in fact from a different population. The difference between experimental and control means were not statistically significant for pre-test measures.

Table VII. Pre-test means and Standard Deviations for Gifted and Regular Students

Group	N Student	$\bar{M}$	SD	df	t
Gifted					
Experimental	48	24.9	7.5	74	1.25
Control	27	22.9	4.8		
Regular					
Experimental	250	21.0	2.7		

In order to perform the analysis for treatment effects, a random selection of subjects was taken from the gifted experimental group to correspond with the number of available subjects in the control group (N=27). This was necessary because the experimental group contained more subjects than the control group. After this adjustment, a one way analysis of variance was performed to determine if any treatment effects occured. The table below shows the results of this analysis.

[2]Gifted students are defined in this study by the Washington State definition of Academically Gifted and required by the participating district, Shoreline School Districts #412, of having an I.Q. of 130 and up.

Table VIII. Analysis of Variance for Treatment Effects for Gifted Students

Source	df	SS	MS	F
between	1	2280.0	2280.9	43.4*
within	52	2737.4	52.6	
TOTAL:	53	5018.3		

*P < .01

As can be seen from Table VIII a strong treatment effect occured for this analysis. Table IX shows the direction of this effect.

Table IX. Means and Standard Deviations for Post Measures of Gifted Students

Group	N Students	$\bar{M}$	SD
gifted experimental	33	40.0	6.9
gifted control	33	27.1	7.4

As is apparent from Table IX, the treatment effect is in the predicted direction. For both the experimental and control groups, the pre and post tests scores were higher for the gifted population than for the normal population. In addition, the gains were greater for the gifted students in both groups. These data tend to support the concept of giftedness. It should also be noted that these students (gifted) did not "top out" on the post test, thus indicating that the material was well within the appropriate range of study for this group.

Table X. Analysis of Mastery of Archeological Knowledge

Group	$\bar{X}$
College Archeology Students	44.3

Group	Mean Pretest	Mean Post-test
Experimental 6,7,8th grades	21.0	32.3
Control 6,7,8th grades	21.4	23.6
Gifted- Experimental	24.9	40.0
Gifted- Control	22.9	27.1

Because no normative data were available to establish mastery of archeological knowledge, the $\bar{X}$ pre and post scores of project students were compared to the $\bar{X}$ scores of college archeology students. As is shown in Table X the project experimental students were able to obtain a 48.4% gain and the gifted experimental students a 90.3% gain when compared to the college archeology students.

Overall Project Results

a. The program of instruction in archeology was highly effective both statistically and educationally across a wide variety of students and teachers drawn from diverse school districts.

b. The possibility of successful dissemination is enhanced by the fact that all of the curriculum need not be presented to achieve good results and by the fact that many school districts were represented.

c. Analysis of the test scores indicates that if a district is intending to adjust this curriculum, that more than 50% of the curriculum needs to be taught to achieve significance. And, that if the students are in the 6th grade, 75% instruction seems to be the necessary level.

d. The program is appropriate for 6th, 7th and 8th graders in both science and social studies classes.

e. The program is appropriate for use with gifted students at the elementary school level.

f. The overall consistency of the data (i.e., randomness, variance, outcomes) indicated that this study was carefully planned and executed.

g. This project has achieved educational significance. The mean for the experimental group is greater than one standard deviation above that of the control groups mean.

TABLE XI. Statistical Educational Significance

Average Students	$\bar{M}$	SD	SD+M	ERROR OF MEASUREMENT
Experimental	32.3	3.5		5.6
Control	23.6	3.1	26.7	

Gifted Students	$\bar{M}$	SD	SD+M	ERROR OF MEASUREMENT
Experimental	40.0	6.9	X	5.5
Control	27.1	7.4	34.5	

VII. COST INFORMATION/ PER LEARNER TABLE

The following budget has been set up for 4 teachers with one kit per teacher. There are, however, a number of variables which will change this budget according to the adopter's needs.

	Installation Non-recurring Costs	Subsequent Years Recurring Costs
*Staff Training		
5 days @ 50 X 4 teachers	$1,000.00	-0-
4 days @200 X 2 trainers	$1,600.00	-0-
Supplies and Materials		
purchase of screens, trowels, clay as per P.A.S.T. supply list @275 per teacher X 4 teachers	$1,100.00	.50 per child
Instructional Material		
Manuals, filmstrips, maps, student books, artifakes, games, @ 300 per teacher X 4 teachers	$1,200.00	-0-
*Evaluation Program		
printing, mailing, scoring, analysis, and reporting for 4 class-rooms using pre/post format	$ 600.00	-0-
Travel		

Approximate costs for transportation:

West Coast @ $250.00
Central @ 400.00
East Coast @ 500.00

per diem
$35-$55/day depending upon the region

Please recommend hotel within the vacinity of the workshop site.